## REMARKS

Claims 1-12 are pending in the present application. Claims 1, 5, and 9 were amended. Support for these amendments may be found at least on page 8, line 15 to page 9, line 10. Reconsideration of the claims is respectfully requested.

### I. 35 U.S.C. § 103, Obviousness, Claims 1, 3-5, 7-9, 11, and 12

The examiner has rejected claims 1, 3-5, 7-9, 11, and 12 under 35 U.S.C. § 103 as being unpatentable over *Beavers et al.* (U.S. Patent No. 6,307,701) in view of *Alex* (U.S. Patent No. 6,628,466). This rejection is respectfully traversed.

With respect to claim 1, the examiner states:

> Regarding Claim 1,Beavers et al. teaches a method for writing data in a tape drive, the method comprising:
>
> Allocating a blank area for transpose writing on a magnetic tape (Col. 11, L. 65 to Col. 12, L. 1, wherein it teaches that it allocates the head at the beginning of a new (i.e. blank) target track.);
> Writing a first plurality of data sets on the magnetic tape adjacent to the blank area, wherein the tape drive maintains full operating speed during intervals between writing successive data sets, resulting in spaces between the data sets (Col. 12, L. 1-13, wherein it teaches monitoring the speed to fall within a full operating speed by differentiating within a minimum and a maximum thresholds.);
>
> Even though Beavers et al. teaches writing the same data set (which are dummy tracks) in two differing positions, it does not explicitly teach the repositioning the tape at a specified interval. Alex teaches the action of when verifying during an interval if the data is correct, it then relocates the data and rewrite the same set of data blocks as explained in Col. 1, L. 55 to Col. 2, L. 5 and the Summary of the Invention. It would have been obvious to a person of ordinary skill in the art, at the time the invention was made, to modify Beaver et al.'s invention with the teaching of Alex in order to be able to acquire erroneous recorded data.

Office Action dated November 17, 2005, pages 2-3.

The examiner bears the burden of establishing a *prima facie* case of obviousness based on the prior art when rejecting claims under 35 U.S.C. § 103. *In re Fritch*, 972 F.2d 1260, 23 U.S.P.Q.2d 1780 (Fed. Cir. 1992). To establish a *prima facie* case of obviousness, the examiner must show some suggestion or motivation to combine or modify reference teachings, show a reasonable expectation of success, and show that the cited references teach or suggest all of the claim limitations. MPEP § 706.02(j). Amended independent

claim 1, which is representative of amended independent claims 5 and 9 with regard to similarly recited subject matter, reads as follows:

> 1. A method for writing data in a tape drive, the method comprising:
> allocating a blank area for transpose writing on a magnetic tape;
> writing a first plurality of data sets on the magnetic tape adjacent to the allocated blank area, wherein the tape drive maintains full operating speed during intervals between writing successive data sets, resulting in spaces between the data sets; and
> performing a single repositioning of the tape at a specified interval and writing a transposed data block to the allocated blank area, wherein the transposed data block contains the same content as the first plurality of data sets.

*Beavers* teaches a system for varying track recording speed to maximize host-to-tape data transfer rates. *Beavers* accommodates the variable data transfer rates of host systems and networks by continually adjusting the tape speed to match the tape drive to the host's actual transfer rate. The speed of the tape is adjusted according to the level of data present in the tape drive data buffer and whether the current mode of the drive is write mode or read mode. (*Beavers*, Abstract). Applicants agree with the examiner that *Beavers* does not teach repositioning of the tape at a specified interval and writing a transposed data block to the allocated blank area, wherein the transposed data block contains the same content as the first plurality of data sets as recited in claim 1.

However, *Beavers* also teaches away from the presently claimed invention since *Beavers* directs one to use dummy tracks to ensure the reliability of the data written onto the tape, rather than allocating a blank area of the tape and then writing a transposed data block on the tape to the allocated blank area. The examiner equates the dummy tracks in *Beavers* to the allocated blank area in the present invention; however, *Beavers* teaches that no data is ever written to the dummy track areas that are adjacent to the actual data tracks. Rather, *Beavers* employs dummy tracks to ensure that a next write head phase will not affect the reliability of actual data written onto the tape, as any overlap in the write will occur in the dummy tracks. If the dummy tracks in *Beavers* are used as the allocated blank area recited in claim 1, any transposed data written to the allocated blank area may be overwritten, since *Beavers* teaches that data is not written to the dummy

tracks. Thus, one of ordinary skill in the art would not be motivated to make the changes proposed by the examiner.

*Alex* does not cure the deficiencies of *Beavers*. As discussed in the Abstract, *Alex* is directed to a system for writing data to a storage medium and automatically refreshing the data to avoid loss of the data due to spontaneous thermal degradation. When an indicator indicates that the data needs to be refreshed, a "refresh" operation is performed, wherein the to-be-refreshed data is read from and written back to the same or different storage medium, prior to the occurrence of a non-recoverable error ("hard" error).

*Alex* does not teach or suggest performing a single repositioning of the tape at a specified interval and writing a transposed data block to the allocated blank area, wherein the transposed data block contains the same content as the first plurality of data sets. The examiner points to the following cited sections of *Alex* as teaching this feature:

> If a media defect exists, Data Lifeguard rewrites the corrected data back to the original sector, then rereads it to ensure that the sector is fixed. If the error recurs on reread, Data Lifeguard then relocates the sector to a spare pool and writes the corrected data to the spare sector. When the off-line scan encounters sectors that require extensive retries for error recovery, Data Lifeguard again performs the Sector Test. If the error still recurs on reread, Data Lifeguard then relocates the sector to the spare pool and writes the corrected data to the spare sector. Data Lifeguard also protects future data to be written to suspect sectors. When the off-line scan encounters an ECC Uncorrectable Error, Data Lifeguard updates the drive's internal defect list for the suspect sector. The next host write command to the suspect sector will perform a Sector Test after the write to ensure that the user data written is readable. If an error occurs during the reread, Data Lifeguard relocates the sector to the spare pool and writes the user data to the spare sector.

*Alex*, col. 1, line 55 to col. 2, line 5.

> An apparatus and method in accordance with the invention write data to a storage medium, e.g., a magnetic medium (such as a hard disk, a floppy disk, or a tape), and refresh the data prior to the occurrence of a non-recoverable error (also called "hard" error) in the data. Specifically, in one embodiment, the data is stored in an areal density that is sufficiently high to cause spontaneous degradation (e.g. loss in amplitude of a readback signal) of the data over time. Whenever necessary, the written data is read and used in the normal manner (although the amplitude of the readback signal reduces with time).
>
> Subsequent to the writing of data and before a hard error occurs due to spontaneous degradation, the apparatus and method perform a "refresh" operation. In the refresh operation, the to-be-refreshed data is read from the

storage medium and re-written (either on the same or different storage medium depending on the embodiment). Repeated performance of the refresh operation allows data to be stored for an indefinite period of time, and at densities sufficiently high to result in some degradation prior to each refresh operation, while avoiding a hard error.

In one implementation, the apparatus and method perform the refresh operation only on occurrence of a predetermined event, e.g. when an indicator (also called "refresh indicator") satisfies a predetermined condition, indicating that data needs to be refreshed (e.g., because the data is about to contain one or more recoverable errors, also called "soft" errors). Depending on the embodiment, the apparatus and method may save the refresh indicator contemporaneous with writing of the data. Alternatively, the refresh indicator can be built into the apparatus or method (e.g. hardcoded in software). Use of the refresh indicator eliminates the need to scan the hard disk (as required by, e.g. Data Lifeguard) to identify the to-be-refreshed data. Instead, use of the refresh indicator automatically identifies to-be-refreshed data, even before a hard error occurs, thereby to prevent data loss.

In one example, the apparatus and method read the data back contemporaneous with writing of the data, and measure an amplitude (or other property) of a readback signal, and store as the refresh indicator a predetermined fraction (e.g. half) of the measured value. In this example, the amplitude of the readback signal reduces over time, as the magnetization in the storage medium become disordered (e.g. due to thermal energy). When the current value of the amplitude falls below the stored value, the data is refreshed. The predetermined fraction is determined by testing the storage medium under realistic conditions until one or more soft errors (or a hard error in another implementation) occurs, followed by dividing the amplitude's value (at the time of error) with the amplitude's value at the time of writing.

In another embodiment, a duration (or a fraction thereof) for which the data can be read without error (also called "error-free duration") is added to the current date, to compute a date in future (also called "next refresh date" or simply "refresh date") when the data needs to be refreshed. The apparatus and method store the next refresh date as the refresh indicator. After the error-free duration, the refresh date becomes older than the current date, and the apparatus and method perform a refresh operation, and reset the refresh date.

Instead of using a refresh indicator, other techniques can be used in other implementations. For example, data can be refreshed periodically (e.g. once a day), regardless of the amount of degradation in the data (e.g. without performing an off-line scan). As another example, a refresh operation may be performed in response to a predetermined event, such as the detection of a soft error. Alternatively, two amplitudes may be compared, wherein a first amplitude is of the to-be-refreshed data, and a second amplitude is of a test signal that has just been written, thereby to determine if there is a loss of amplitude by a predetermined amount (and if so, a refresh operation is performed).

> The refresh operation can be repeated any number of times, to maintain the data without irrecoverable loss for an indefinite time period, thereby to allow storage of data at densities that otherwise result in spontaneous loss of data over time. Specifically, data can be deliberately stored in grains having magnetization energy (defined to be K.sub.u V wherein K.sub.u is grain anisotropy and V is the grain volume) that is less than the energy normally used to ensure avoidance of spontaneous demagnetization by thermal energy. Such use allows the areal density (defined to be number of bits in a unit area) of the stored data to be increased significantly (e.g. by an order of magnitude), as compared to areal densities in the prior art. The areal density can be increased by decreasing the diameter of each grain or by decreasing the number of grains being used to hold a single bit of data, or both. The areal density can also be increased by storing adjacent bits closer to one another. Any such increase in areal density allows storage media (such as hard disks or tapes) to have increased data storage capacity, as compared to the prior art.

*Alex*, Summary.

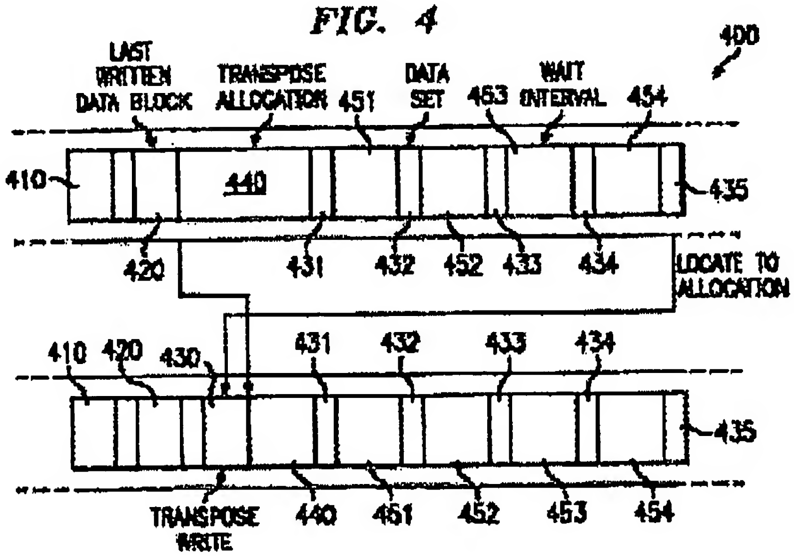
The first passage above discloses a "Data Lifeguard" feature that, in response to a media defect, rewrites the corrected data back to the original sector of the tape, and then rereads the data to verify the sector is fixed. If an error occurs on reread, the Data Lifeguard may relocate the sector to a spare pool and write the corrected data to the spare pool. The Summary discloses writing data to a storage medium and performing a "refresh" operation prior to the occurrence of a non-recoverable error. When a refresh indicator identifies to-be-refreshed data, the refresh operation is performed by reading and then rewriting the data back to the same or different storage medium.

Although *Alex* teaches reading and rewriting data to a same or different sector of a storage medium, *Alex* does not teach performing a single repositioning of the tape to write a transposed data block containing the content of the plurality of data sets previously written at full operating speed to the allocated blank area. *Alex* merely discloses refreshing data prior to the occurrence of a non-recoverable error in the data. A "refresh" operation is used when data is stored in an areal density that is sufficiently high to cause spontaneous degradation (e.g. loss in amplitude of a readback signal) of the data over time (*Alex*, Summary). In the refresh operation, upon determining that a refresh indicator is set, the to-be-refreshed data is read and re-written back to the same file or a new file (*Alex*, col. 6, lines 27-33). Repeated performance of the refresh operation allows data to be stored for an indefinite period of time, and at densities sufficiently high to

result in some degradation prior to each refresh operation, while avoiding a hard error (*Alex*, Summary).

However, there is no mention in the *Alex* reference that a single repositioning of the tape occurs to write a transposed data block comprising the content of the plurality of data sets. Claim 1 of the present invention recites that a plurality of data sets may be written at full operating speed (without repositioning between data sets), and then the content of the plurality of data sets may be written to an allocated blank area, which is adjacent to the plurality of data sets. Figure 4 of the present invention is provided below to illustrate this process.

FIG. 4




As shown, after data sets 431-435 are written at full operating speed, transposed data block 430 is written to allocated blank area 440 in a single repositioning of the tape. Thus, while claim 1 recites performing a single repositioning of the tape to write a transposed data block containing a plurality of previously written data sets to the allocated blank area, *Alex* fails to disclose or suggest using a single repositioning of the tape to rewrite a plurality of data sets to an allocated blank area.

*Alex* also does not teach or suggest writing the transposed data block to the allocated blank area. As recited in claim 1, the allocated blank area of the present invention is a location on the tape that is adjacent to the location of the plurality of data sets written on the tape. *Alex* does not mention writing data to a location on the tape that

is adjacent to the original sector of the data. Rather, *Alex* merely mentions writing data to the same sector, a different sector, or a different storage medium altogether. Alex does not teach or suggest writing the data to an area adjacent to the original sector, nor does *Alex* mention the desirability of doing so.

In addition, *Alex* actually teaches away from the presently claimed invention since *Alex* directs one to perform "refresh" operations that read data from a sector of the tape and then write the data back to the same sector of the tape (*Alex*, col. 6, lines 27-31). *See In re Hedges*, 228 U.S.P.Q. 685 (Fed. Cir. 1986). Thus, *Alex* discloses rewriting data to the same sector of the tape in order to prevent data degradation, rather than write transposed data to an allocated blank area of the tape adjacent to the plurality of consecutive data sets.

Furthermore, one of ordinary skill in the art would not combine or modify *Beavers* with *Alex* in the manner required to form the solution disclosed in the claimed invention. The present invention recognizes the problem of having increased repositioning times when writing consecutive data sets to a tape due to higher density data storage and increased tape speeds found in modern tape drives. When writing consecutive data sets, there is a wait interval between writing data sets, which results in blank space on the tape between the data sets. The present invention recognizes that to minimize the space between consecutive data sets, the tape drive must rewind the tape between each write operation. Repositioning time is the time needed to decelerate, reposition the tape, and ramp up to full operating speed before being allowed to perform the next write operation. The present invention solves this problem by writing consecutive data sets at full operating speed and then writing transposed data comprising the content of the data sets to a blank area of the tape using a single repositioning of the tape rather than the multiple repositions necessary in prior methods.

*Beavers* does not teach the problem or its source. Instead, *Beavers* is directed towards varying track recording speed to maximize host-to-tape data transfer rates. *Beavers* is concerned with continually adjusting the tape speed to match the tape drive to the host's actual transfer rate to accommodate the variable data transfer rates of host systems and networks. The speed of the tape is adjusted according to the level of data present in the tape drive data buffer and whether the current mode of the drive is write

mode or read mode (*Beavers*, Abstract). However, nowhere does *Beavers* teach or suggest reducing repositioning time by replacing the multiple repositions with a single reposition of the tape. *Alex* also does not teach the problem or its source. Instead, *Alex* is directed towards writing data to a storage medium and automatically refreshing the data to avoid loss of the data due to spontaneous thermal degradation. A "refresh" operation is performed wherein the to-be-refreshed data is read from and written back to the same or different storage medium, prior to the occurrence of a non-recoverable error or "hard" error. *Alex* is not directed towards reducing repositioning time by replacing the multiple repositions with a single reposition of the tape. Therefore, one of ordinary skill in the art would not be motivated to combine or modify the references in the manner required to form the solution disclosed in the claimed invention.

Furthermore, as noted above, there is no teaching or suggestion in the references as to the desirability of including the features from the other references. As the examiner has failed to demonstrate any motivation or incentive in the prior art to combine and modify the references so as to achieve the claimed invention, the alleged combination can only be the result of impermissible hindsight reconstruction using applicant's own disclosure as a guide. While applicant understands that all examination entails some measure of hindsight, when the rejection is based completely on hindsight, as in the present case, to the exclusion of what can be gleaned from the references, then the rejection is improper and should be withdrawn.

Even if *Beavers* is combinable with *Alex*, the result of such a combination would not be the invention as recited in claim 1. Rather, such an alleged combination would result in a system that employs dummy tracks (in which no data is ever written) adjacent to the data tracks to ensure that a next write head phase will not affect the reliability of actual data written onto the tape as taught by *Beavers*, in addition to the feature of reading and rewriting data back to the tape to prevent data degradation. Even considering *Alex*, the cited references still fail to teach or suggest performing a single repositioning of the tape at a specified interval and writing a transposed data block to the allocated blank area, wherein the transposed data block contains the same content as the first plurality of data sets as recited in claim 1.

In view of the above, *Beavers* does not teach the features of claims 1, 5, and 9. At least by virtue of their dependency on claims 1, 5, and 9, respectively, *Beavers* also does not teach the features of dependent claims 2-4, 6-8, and 10-12.

Therefore, the rejection of claims 1, 3-5, 7-9, 11, and 12 under 35 U.S.C. § 103 has been overcome.

## II. 35 U.S.C. § 103, Obviousness, Claims 2, 6, and 10

The examiner has rejected claims 2, 6, and 10 under 35 U.S.C. § 103 as being unpatentable over *Beavers et al.* and *Alex* and further in view of *Dobbek et al.* (U.S. Patent No. 6,034,831). This rejection is respectfully traversed.

Claims 2, 6, and 10 are dependent claims dependent from independent claims 1, 5, and 9, respectively. The combination of *Beavers* and *Dobbek* do not teach or suggest the present invention as recited in claims 2, 6, and 10. As argued in the response to the rejection of claim 1 above, the features relied upon as being taught in the *Beavers* reference are not taught or suggested by that reference. As a result, a combination of the *Beavers* and *Dobbek* references still would not reach the claimed invention in claims 2, 6, and 10.

Therefore, the rejection of claims 2, 6, and 10 under 35 U.S.C. § 103 has been overcome.

## III. Conclusion

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

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Respectfully submitted,

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